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Epigrowth Organisms on Reared Larvae of the European Lobster, Homarus gammarus.

(Påvekstorganismer hos oppdrettede hummerlarver).

By

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Norwegian aquaculture is at the present time in a period of rapid development. The rearing of salmon has, to a large extent, been the driving force, but in recent years the interest in rearing other organisms has increased. This applies especially to marine fish and shellfish. The interest in rearing crustacea has been somewhat less, but both the freshwater crayfish Astacus astacus and lobster Homarus gammarus are species of interest for culture (Johannesen 1984, Hessen & Skurdal 1985).

Even if it is known that lobster culture experiments have been carried out in Norway since the 1860's (Dannevig 1928a), there is today only one commercial installation for rearing lobsters and one for crayfish in operation. Diseases and parasites have created problems earlier and will most likely also create problems in the future.

The lobster has large eggs, and the larvae are ca.8mm long when hatched. The larvae are planktonic and go through 4 stages before they seek towards the bottom after about 3 weeks at 15°C (Kinne, 1977). Even if a number of systems for rearing lobsters have been described (Dannevig 1928b, Sastry 1975, Beard et al. 1985), it appears that many basic biological studies still remain to be done to improve the rearing process (Beard et al. 1985). In this article we will report on some epibiotic organisms that were found on lobster larvae (Fig.1) during a rearing experiment.

MATERIALS AND METHODS

The rearing experiment was carried out at the Aquaculture Experimental Station at Austevoll in the period June 10 - 25, 1985. A total of between 1000 and 1500 newly hatched lobster larvae were transferred to each of 4 conical tanks (Volume ca. 200 litres). The larval density was about 5 -7.5 larvae per litre. The tanks were made of white translucent glass fibre and were covered with black plastic. The tanks were placed outdoors and filled with seawater filtered through sand (pore size about 15 µm). The throughflow of water in each tank was about 2 litres per minute. Salinities and temperatures varied respectively between 29 - 30 ‰ and 10.5 - 14.5° C. The larval density was the same as that used by Dannevig (1928b), but the water circulation period (turnover) was longer in our experiment; 100 minutes as compared to 12 minutes. The larvae were fed every second day. The feed consisted partly of live zooplankton caught by filtering seawater through a cloth with a mesh size of 250 µm, and partly with frozen copepods, mainly " red feed" Calanus finmarchicus. The water in the tanks was circulated with the help of air bubbles, to prevent cannibalism. Some of the larvae (8 - 10 mm long) that could be observed to be infected with the naked eye, were fixed in 4% formalin on June 25, 1985. Small pieces of the exoskeleton of these larvae were torn off for microscopic examination. Some pieces (0.3 - 2.0 mm^2, n=8) were stained with silver-Protargol (Lee et al. 1985) in order to be able to identify the ciliates (Dale 1983, 1985). All pieces,

a total of 8.2 mm^2, were examined. The total surface area of a larva without claws or legs was 38.6 mm^2.

RESULTS

The epigrowth organisms were first observed with the naked eye towards the end of the first week. The degree of infection increased during the second week. The mortality of the lobster larvae was about 80% after one week and 99% after two weeks. The infected larvae became less active and accumulated on the bottom of the tank in spite of the water circulation. The surviving larvae had grown little and had not developed further than to stage 2.

Some of the infected larvae were treated with 250 ppm formalin for 20 - 30 minutes 10 days after the experiment had started, but these larvae also died. p.17

Microscopic studies showed that the larvae were densely overgrown with ,among others, several species of ciliates. Two of the observed species belong to respectively the Zoothamnium (Fig. 2A) and Vorticella (Fig.2B) families. Both these large families belong to the order Peritrichida (peritrichous ciliates). The two other species of ciliates observed, Acineta tuberosa (Fig. 2C) and Ephelota pusilla (Fig. 2D) belong to the class Suctoria. The larvae were also densely overgrown with a filamentous bacterium, probably Leucothrix mucor (Fig. 2E). In addition, many benthic diatoms were found on the larvae, among those Licmophora sp. (Fig.2F). The densities of ciliates and diatoms on the Protargol-

stained samples were respectively 48.5 cells per mm^2 and 18.9 cells per mm^2 of the surface of the lobster larvae (Tab. 1). This corresponds to about 1870 ciliates and 730 diatoms per larva.

DISCUSSION

It is usual that aquatic crustacea have epibionts (Fenchel 1965), but the occurrence is usually so low that they do not b ther the host. However, in artificial rearing, favorable conditions for various epibionts are often created. Epigrowth organisms on lobster larvae are best documented for the American lobster Homarus americanus. On eggs and larvae of this species, Vorticella sp. and Leucothrix mucor (Fisher et al. 1975) and diatoms (Nilson et al. 1975) have earlier been observed. However, the suctorian ciliates E. Pusilla or A.tuberosa, or the vorticellidae, Zoothamnium sp., have not been reported on American lobster, even if both Acineta sp. and Zoothamnium sp. seem to be common on farmed shrimp (Johnson 1978). On the European lobster, to our knowledge only Ephelota gemmipara (Dannevig 1939) and p.18 probably L. mucor (Dannevig 1919) have earlier been documented. There is , however, reason to assume that this low number of epibionts is due to few observations rather than few species.

In general it can be said that peritrichous ciliates, suctorian ciliates, benthic diatoms and filamentous bacteria can fasten themselves to many types of substrate. They can attach themselves to rocks, crustacea and algae if the surrounding water fills the ecological requirements for nutrients, circulation, etc.

The biology of many epigrowth organisms is little known. It is possible that some of the ca. 1000 peritrichous ciliates require quite specific substrates like for example lobster larvae. Fenchel (1965) assumes that most of the ciliates found on Gammarus spp. are specific for this genus.

In spite of the precautions taken (filtering of water, washing the tanks) in our experiments, the larvae were heavily infested. Dannevig (1939) also had heavy infestation of the suctorian ciliate Ephelota gemmipara on lobster larvae in the 1926 and 1936 seasons. He assumed that the high mortality of lobster larvae in these years were caused by these. Since no samples of inner organs were taken in our experiments, it cannot be precluded that the cause of death was disease caused by bacteria such as Gaffkya sp. or Vibrio sp., or fungi like Lagenidium sp. or Haliphtorous sp., and that the observed epigrowth organisms only were secondary infections. It is assumed, however, that a heavy growth of ciliates and filamentous bacteria alone on crustacea can lead to suffocation (Couch 1978, Foster et al. 1978), or damage to the exoskeleton (Turner et al.1979). A weak formalin solution is commonly used to fight epigrowth organisms. Since our treatment did not prevent the death of the larvae, it is possible there was an inner infection present. However, it could also mean that the larvae were so weakened by the epibionts at the time of the treatment that the formalin treatment could not save them, or that the treatment time was too long so that the formalin hurt the larvae (Overstreet 1985).

In our experiments there were several possible sources for the observed epibionts. It is possible that the sand filter used could have prevented an infection of ciliates and diatoms but hardly the filamentous bacteria . All the epibionts could, however, probably have come both from the lobster eggs (Dannevig 1939, Nilson et al. 1975), or from the live feed (Sherman & Schaner 1965, Turner et al. 1979, Nicol 1984, Hiromi et al. 1985)

This experiment shows some of the problems attached to the rearing of lobsters. Preventive treatment with chemicals and medicines can possibly prevent infections. However, this is a poor solution since it is desirable to keep the use of medicines in rearing at as low a level as possible. Through increased knowledge of the biology of the lobster and the epibionts, it will be possible to find the best technical and economic solutions for rearing lobsters and crayfish. The pore size in the filtration of the incoming water is an important factor in this connection. Choice and handling of feeds is another important factor. It would also seem possible to utilize biological methods to fight the epigrowth organisms. It is known that there are ciliates and other species that feed on peritrichous ciliates. There is also a ciliate, Hypocoma parasitica, which is a characteristic parasite on colony - forming peritrichous ciliates (Fenchel 1965)

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ABSTRACT

Dale, T. & Blom, G. 1987. Epigrowth organisms on reared larvae of the European lobster *Homarus gammarus*. *Fauna 40,* 16—19.

Larvae of the European lobster *Homarus gammarus* reared in tanks flushed with sand-filtered (pore size approximately 15 μm) seawater were heavily infested by the peritrichous ciliates *Zoothamnium* sp. and *Vorticella* sp., the suctorian ciliates *Acineta tuberosa* and *Ephelota pusilla* (48.5 ciliates pr. mm²), by benthic diatoms (18.9 diatoms pr. mm²), among them *Licmophora* sp., and by filamentous bacteria, probably *Leucothrix mucor*. Larval mortality was 80% after one week and 99% after two weeks. It is not known whether the death was caused by the epibionts or some undetected bacterial or fungal infection. The infestation of the epibionts probably initiated from the lobster eggs, from the live zooplankton offered as food, or both.

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Fig. 1. Hummerlarve med påvekstorganismer.
Larvae of European lobster with epibiotic organisms.

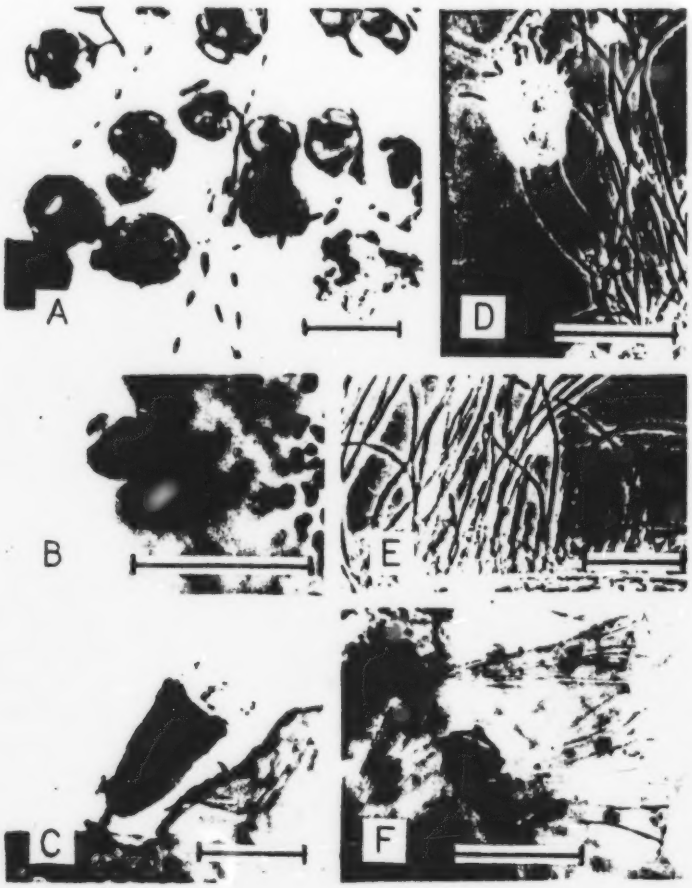

Fig. 2. Påvekstorganismer funnet på oppdrettede larver av europeisk hummer, A: *Zoothamnium* sp. (farget med protargol), B: *Vorticella* sp. (protargol), C: *Acineta tuberosa* (protargol), D: *Ephelota pusilla* (formalin, fasekontrast), E: *Leucothrix mucor* (formalin, fasekontrast), F: *Licmophora* sp. (protargol), skalaenhet = 40 μm.
Epibiotic organisms found reared larvae of European lobster. A: Zoothamnium *sp. (protargol stained), B:* Vorticella *sp. (protargol), C:* Acineta tuberosa *(protargol), D:* Ephelota pusilla *(formalin, phase contrast), E:* Leucothrix mucor *(formalin, phase contrast), F:* Licmophora *sp. (protargol), scale bar* = 40 μm.

Tabell 1. Antall (n), relativ frekvens (%), og tetthet (celler pr. mm²) av flimmerdyr og kiselalger på protargol-fargede prøver (areal 8.2 mm²) av infiserte, oppdrettede larver av hummer *Homarus gammarus*.
Numbers (n), relative frequencies (%) and densities (cells pr. mm²) of ciliates and diatoms found on protargol stained samples (area 8.2 mm²) of infested, reared larvae of lobster Homarus gammarus.

Organisme	n	%	Antall celler pr. mm²
Flimmerdyr			
Zoothamnium sp.	331	83.2	40.4
Vorticella sp.	27	6.8	3.3
Acineta tuberosa	38	9.5	4.6
Ephelota pusilla	2	0.5	0.2
Totalt flimmerdyr	398	100.0	48.5
Kiselalger			
Licmophora sp.	48	31.0	5.9
Kiselalger ubestemt (15—20 μm)	107	69.0	13.0
Totalt kiselalger	155	100.0	18.9